www.sciencemag.org/cgi/content/full/321/5885/48/DC1

Supporting Online Material for

Transient Dynamics for Neural Processing

Misha Rabinovich, Ramon Huerta, Gilles Laurent*

*E-mail: laurentg@caltech.edu

Published 4 July 2008, *Science* **321**, 48 (2008)
DOI: 10.1126/science.1155564

This PDF file includes:

SOM Text

M Rabinovich, R Huerta and G Laurent

Generalized Lotka-Volterra Model

$$\frac{dA_j(t)}{dt} = A_j(t)F\left(\sigma_j(I_k) - \sum_{i=1}^{N}\rho_{ji}A_i(t) + \eta_j(t)\right), \; j = 1,\ldots,N \text{, and } F(0) = 0 .$$

The variables $A_j(t) \geq 0$ may have different meanings depending on the problem or system considered: they can represent the firing rate of excitatory neurons, the amount of biomass in ecological communities, or the probability of using a particular strategy in game theory.

$\eta_j(t)$ represents noise, or random perturbations on the system.

I_k is an environmental stimulus.

$\sigma_j(I_k)$ is the gain function that controls the impact of the stimulus.

ρ_{ji} determines interactions between the variables. In ecology, this connectivity is called the community matrix. For $\rho_{ji} > 0$, all agents compete with each other. In the locust antennal lobe, competition is implemented via inhibitory connections.

Without noise the generalized Lotka-Volterra model has many positive fixed points; whether these are saddles or nodes depends on the values of ρ_{ji}.

For a 3-dimensional system, the typical behavior of the generalized Lotka-Volterra model is a sequential switching of the agent's activities (stable heteroclinic cycle in phase space). For larger dimensions, three types of dynamics can be observed: periodic or chaotic recurrent switching, and finite sequential switching ending at a simple attractor.